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ABSTRACT

This methodological report describes in five chapters the techniques and assumptions that underlie and greatly influence the projections shown in the first volume of "Projections of Education Statistics to 1990-91." Chapter 1 describes the general methodology and assumptions used to produce the projections in Volume I. Chapters 2 through 5 provide specific information on the methodology and assumptions used to produce the projections for each corresponding chapter of Volume I. Each of these chapters contains the following information: (1) a description of the basic methodology; (2) tables of projection equations and related statistics; (3) tables of percentages and rates used to make projections; (4) a table of basic assumptions underlying the projections; and (5) a table describing the methods used to estimate missing data items. The report's appendix contains tables of economic and demographic time-series data that were also used to produce the projections in Volume I. (Author/MLF)

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Projections of Education Statistics to 1990-91

National Center for Education Statistics

Volume II: Methodological Report

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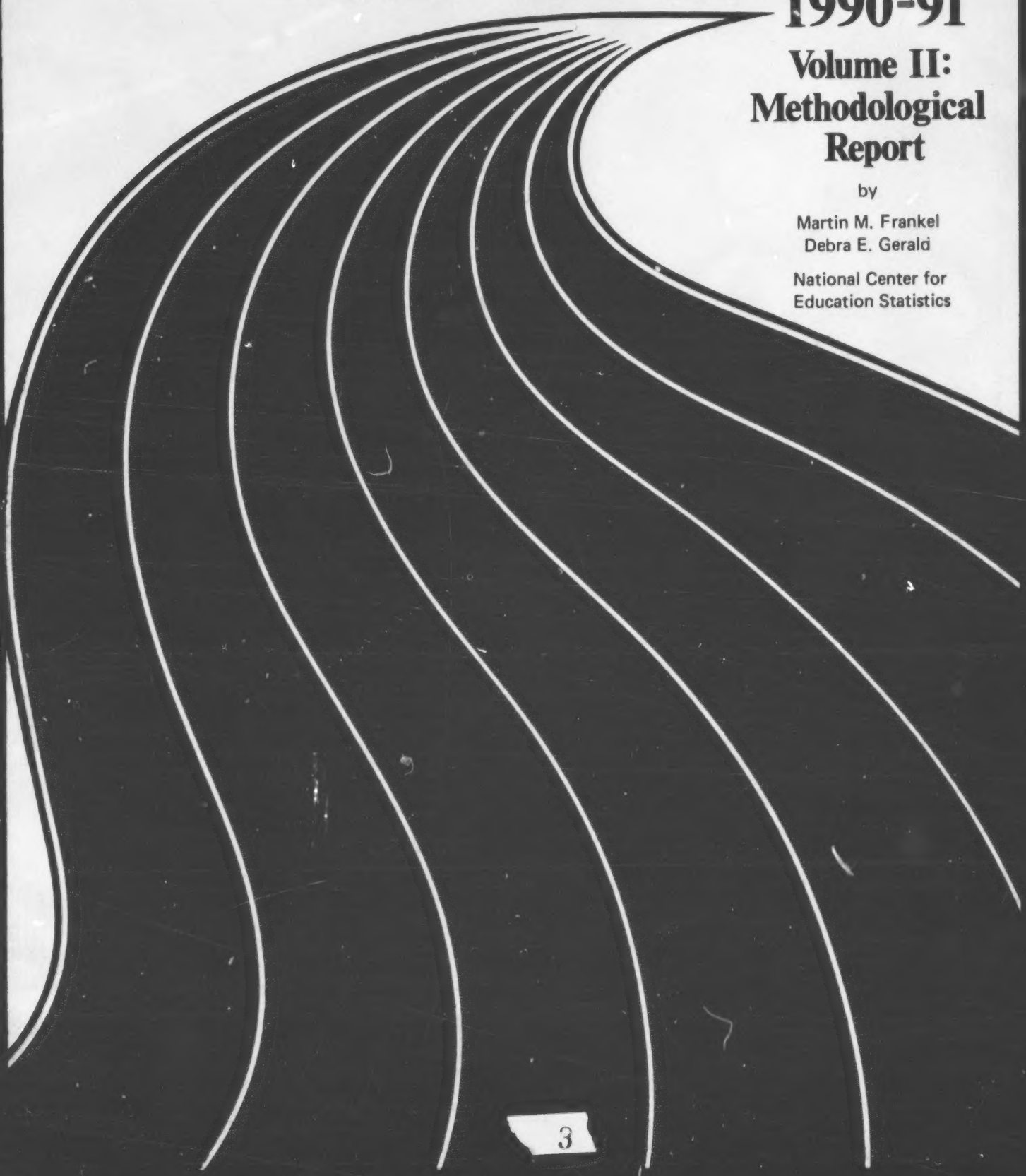
Projections of Education Statistics to 1990-91

Volume II: Methodological Report

by

Martin M. Frankel
Debra E. Gerald

National Center for Education Statistics



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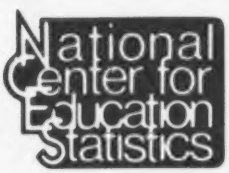

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Foreword

This edition, Volume II of *Projections of Education Statistics to 1990-91* (Methodological Report), is the first to present, in a separate report, the assumptions and methods used to develop these projections. Each chapter in the report presents both general and detailed information on the assumptions and methods used to develop the projections in the corresponding chapters of Volume I of *Projections of Education Statistics to 1990-91* (Analytical Report).

Volume I provides projections of statistics for elementary and secondary schools and institutions of higher education and includes chapters on enrollments, graduates, teachers and expenditures. Likewise, each chapter in Volume II contains the forecasting rates and equations, basic assumptions, and data estimation methods used to develop projections for the corresponding chapter in Volume I.

The report was prepared in the Division of Statistical Services under the general direction of Nancy-Jane Stubbs, Assistant Administrator for Statistical Services, and Forrest W. Harrison, Chief of the Statistical Information Branch. The data and information were analyzed and prepared by Martin M. Frankel and Debra E. Gerald.

For More Information

Information about the Center's statistical program and a catalog of NCES publications may be obtained from the Statistical Information Office, National Center for Education Statistics, Mail Stop 1001, 400 Maryland Avenue SW., Washington, D.C. 20202, telephone (301) 436-7900.

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Introduction

This methodological report describes the techniques and assumptions which underlie and greatly influence the projections shown in Volume I of *Projections of Education Statistics to 1990-91 (Analytical Report)*.

This volume is divided into five chapters. Chapter I describes the general methodology and assumptions used to produce the projections in Volume I. Chapters II through V provide specific information on the methodology and assumptions used to produce the projections in the corresponding chapters of Volume I. Each of the chapters, II through V, contains the following information: (1) a description of the basic methodology; (2) a table or tables of projection equations and related statistics; (3) tables of percentages and rates used to make projections; (4) a table of basic assumptions underlying the projections; and (5) a table describing the methods used to estimate missing data items.

Appendix A of this volume contains tables of economic and demographic time series data that were also used to produce the projections in Volume I.

Chapter I

General Methodology

The general procedure used throughout *Projections* was to convert the variable to be projected to a percentage of a "base" variable for the past 11 years. These percentages were then projected into the future and applied to projections of the "base" variable. For example, the number of 18-year-old college students was converted to their percentage of the 18-year-old population for 1970 through 1980. These percentages were then projected through 1990 and applied to projections of the 18-year-old population available from the Bureau of the Census.

Enrollment projections are primarily based on population projections while instructional staff, graduates and degrees, and expenditure projections are primarily based on enrollment projections.

Exponential smoothing and multiple regression are the two major projection techniques used in this publication. Exponential smoothing places more weight on recent observations than on earlier ones. The weights for observations decrease exponentially as one moves further into the past. As a result, the older the data, the less their influence on projections. The rate at which the weights of older observations decrease is determined by the smoothing constant selected.

For time series that can be described by a local constant model, single exponential smoothing was used. In single exponential smoothing, a single constant value is projected for the entire projection period in the following manner.

$$P = aX_t + a(1-a)X_{t-1} + a(1-a)^2X_{t-2} + a(1-a)^3X_{t-3} + \ldots.$$

Where

P = projected constant

a = smoothing constant $(0 < a < 1)$

X_t = observation for time t

The above equation illustrates that the projection is a weighted average based on exponentially decreasing weights. For high smoothing constant, weights for earlier observations decrease very rapidly. For low smoothing constant, decreases are much more moderate.

For time series that can be described by a local linear model, double exponential smoothing was used. In this method, as the name implies, the smoothed values (single exponential smoothing) are themselves smoothed. This results in a forecast for the slope of the projected line that is based primarily on an exponentially decreasing weighted average of the increments of smoothed values.

In general, the projections in this publication are based on fairly high smoothing constants. The farther apart the observations are spaced in time, the more likely are changes in the underlying social, political, and economic structure. Since the observations are on an annual basis, major shifts in the underlying process are more likely to occur within the time span of just a few observations than if the observations were available on a monthly or weekly basis. As a result, the underlying process tends to be unstable from one observation to the next. Another reason for using high smoothing constants is that most of the observations are fairly accurate, since most observations are population values rather than sample estimates. Therefore, large shifts tend to indicate changes in the process rather than noise in the data. For those cases in which the observations were considered to be less accurate, lower smoothing constants were used.

Multiple regression was also used in making projections, primarily in the areas of teacher supply and demand and expenditures. This technique was used when it was believed that a strong causal relationship existed between the variable being projected (dependent variable) and independent causal variables. However, this technique was only used when accurate data and reliable projections of the independent variables were available.

The functional form primarily used was the multiplicative model. When used with two independent variables, this model takes the form:

$$Y = aX_1^{b_1}X_1^{b_2}$$

This equation can easily be transformed into the linear form by taking the natural log (ln) of both sides of the equation:

$$\ln Y = \ln(a) + b_1 \ln X_1 + b_2 \ln X_2$$

The multiplicative model has a number of advantages; it is a reasonable way to represent much human behavior. Constant elasticities are assumed; this says that a 1 percent change in X will lead to a given percentage change in Y. This percentage change is equal to b_1. And it lends itself easily to "a priori"

analysis because the researcher does not have to worry about units of measurement when specifying relationships. In fact, the multiplicative model is considered the standard in economic problems.[1]

Caveats

Since projections are subject to errors from many sources, those using projections are cautioned against placing too much confidence in the accuracy of numerical values of projections. To emphasize this fact, alternative projections are shown for most statistical series. These alternatives are not statistical confidence intervals, but instead represent judgments made by the authors as to reasonable upper and lower levels for each projected series.

In many cases the high alternative projection was based on one projection technique and the low alternative projection was based on another technique. In such cases, the intermediate alternative projection was usually calculated as the average of the high and low alternative projections. The authors believe that by combining the results of two different projection techniques, the risk of large projection errors can be reduced.

Assumptions

All projections are based on underlying assumptions, and these assumptions determine projection results to a large extent. It is important that users of projections understand the assumptions in order to determine the acceptability of projected time series for their purposes. The tables of assumptions in each chapter describe the primary assumptions upon which the projections of time series are based. For each time series, the respective tables and the assumptions used for each alternative projection are shown.

For most projections, low, intermediate, and high alternatives are shown. These alternatives reveal the level of uncertainty involved in making projections, and they also point out the sensitivity of projections to the assumptions they are based on.

Many of the projections in the publication are demographically based. Bureau of the Census Series II projections of the sizes of various age populations were chosen for use. The future fertility rate assumption, which determines projections of the number of births, is the key assumption in making population projections. The Series II population projections assume an ultimate complete cohort fertility rate of 2.1 births per woman by year 2000. This assumption plays a major role in determining population projections for the age groups enrolled in nursery school and kindergarten and in elementary grades. The effects of the fertility rate assumptions are more pronounced toward the end of the projection period.

For enrollments in secondary grades and college, the fertility assumption is of no consequence, since all students enrolled at these levels were already born when the population projections were made.

For projections of enrollments in nursery schools and kindergartens and in elementary schools, only Series II population projections were considered. The fertility assumptions used in this series have tracked closely to the most recent birth data, whereas Series I and Series III fertility assumptions have been very wide of the mark. For the relatively short range (10 years) of the projections in the publication, Series II population projections should prove to be more accurate than either Series I or Series III.

Many of the projections of classroom teachers and expenditures in regular public elementary and secondary schools are based on projections of per capita income. Per capita income projections were obtained from Data Resources, Inc.'s intermediate trend projections of the U.S. economy. Therefore, the many assumptions made in projecting per capita income also apply to those projections based on projections of per capita income.

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[1] J. Scott Armstrong, *Long Range Forecasting*, John Wiley and Sons, Inc: New York, 1978, pages 180-181.

Chapter II

Enrollment

Enrollment projections were based on projected enrollment rates by age and sex which were applied to population projections by age and sex developed by the Bureau of the Census. These enrollment rates were projected by taking into account the most recent trends as well as the effects of economic conditions and demographic changes on a person's decision to enter college. The enrollment rates were then used in an interactive forecasting model (IFMOD) which consists of age-specific rates by sex and by enrollment levels (nursery school through college). The current model has 5 stages.

The first stage of IFMOD is an age-specific enrollment model in which enrollment rates are projected and applied to age-specific population projections.[1] This stage, which is used separately for each sex, includes the following categories: (1) nursery and kindergarten, (2) elementary grades 1-8, (3) secondary grades 9-12, (4) full-time college enrollment, and (5) part-time college enrollment. For each of these enrollment categories, enrollment rates were projected by individual ages 3 through 24 and for the age groups 25 to 29, 30 to 34 and 35 years and over.

Enrollments by age and age-groups from the Bureau of the Census[2] were adjusted to NCES totals in order to compute enrollment rates for 1970 through 1980. Different assumptions were made in order to produce low, intermediate, and high alternative projections of the past enrollment rates through 1990.

Nursery and Kindergarten

Nursery and kindergarten enrollments were only considered for 3- to 6-year-olds. Table 1 shows the 1980 enrollment rates and high, intermediate, and low alternative enrollment rates for 1985 and 1990. The low alternative enrollment projections were based on constant enrollment rates. Therefore, the rates remained the same throughout the projected period.

Elementary Grades 1–8

Projections of elementary enrollment rates were considered only for ages 5 through 21. Elementary enrollments are negligible for the remaining ages. Since most elementary enrollment rates have been fluctuating at levels close to 100 percent throughout the 1970 to 1980 period, alternative enrollment rate projections were not computed. The only set of enrollment rate projections computed was based on the assumption that rates will remain constant through 1990 (table 2). Several of the rates shown in table 2 exceed 100 percent. This is probably due to several factors. The enrollment data by age were prorated to agree with NCES totals. The Bureau of the Census does not revise enrollment estimates by age, but population estimates are revised regularly.

Secondary Grades 9–12

Projections of secondary enrollment rates were considered only for ages 12 through 34. Secondary enrollments are negligible for the remaining ages. Secondary enrollment rates have fluctuated around constant levels throughout the 1970 to 1980 period. Therefore, alternative enrollment rate projections were not calculated. The only set of projections computed was based on constant enrollment rates (table 3).

College Full-Time and Part-Time Enrollment

Projections of full-time and part-time college enrollments were considered only for ages 16 and over. (College enrollment is negligible for earlier ages.) Three alternative projections were made using various assumptions. Table 4 shows enrollment rates for 1980 and low, intermediate, and high alternative projected enrollment rates for 1985 and 1990.

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[1] Department of Commerce, Bureau of the Census, *Current Population Reports*, "Population Estimates and Projections: Projections of the Population of the United States: 1977 to 2050," Series P-25, No. 704, July 1977.

[2] U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, "Population Characteristics, School Enrollment–Social and Economic Characteristics of Student," 1967 through 1980, Series P-20.

Nursery and Kindergarten Enrollment, by Age, Sex, and Control

The second stage of IFMOD projects enrollments in nursery schools and kindergarten by age and sex of student, and by control of school. Enrollment rates by age, sex, and control were projected independently and then adjusted to agree with low, intermediate, and high nursery and kindergarten enrollment rate projections from the first stage of IFMOD. Table 5 shows actual rates for 1980 and the projected enrollment rates by age, sex, and control used to develop the nursery and kindergarten enrollment projections.

Enrollment in Elementary and Secondary Schools, by Grade Group, Organizational Level, and Control

The third stage of IFMOD projects public and private enrollment in elementary and secondary schools by grade group and by organizational level. Public enrollments by age were based on enrollment rate projections for nursery and kindergarten, grade 1, elementary ungraded and special, secondary ungraded and special, and post-graduate enrollment. Grade retention rate projections were used for grades 2 through 12. Table 6 shows the public enrollment rates and table 7 shows the public grade-retention rates for 1980 and projections for 1985 and 1990. The projected rates in tables 6 and 7 were used to compute the projections of enrollments in elementary and secondary schools by grade shown in table 6.

The public grade retention rates for the 6th to 7th grade and from the 8th to 9th are over 100 percent because large numbers of private elementary students change to public secondary schools at these levels. Projections of public enrollment by organizational level were based on projections of the percentage of 7th and 8th grade students in secondary schools.

Table 8 shows the private grade-retention rates for 1980 (estimated) and projections for 1985 and 1990. These projected rates were used to compute the projections of private enrollments in elementary and secondary schools by grade.

College Enrollment, by Sex, Attendance Status and Level Enrolled by Student, and by Type and Control of Institution

The fourth stage of IFMOD projects enrollments in institutions of higher education by sex, attendance status, and level enrolled by student, and by type and control of institution. For each age group by attendance status and sex, the percentage that enrollment by level enrolled and type of institution was of total enrollment was projected. These projections are shown in tables 8 and 9, along with actual values for 1980. For all projections, it was assumed that there was no enrollment in 2-year institutions at the post-baccalaureate level (graduate and first-professional).

The projected rates shown in tables 9 and 10 were then adjusted to agree with the projected age-specific enrollment rates in the first stage of IFMOD. The adjusted rates were then applied to the projected enrollments by age-group, sex and attendance status from the first stage to obtain projections by age-group, sex, attendace status, level enrolled and type of institution.

For each enrollment category—sex, attendance status, level enrolled and type of institution—the percentage that public enrollment was of total enrollment was projected. These projections are shown in table 11 along with actual percentages for 1980. The projected rates shown were then applied to the projected enrollments in each enrollment category to obtain projections by control of institution.

For each enrollment category by sex and enrollment level and by type and control of institution, the percentage that graduate enrollment was of post-baccalaureate enrollment was projected. Actual graduate rates for 1980 and projections for 1985 and 1990 are shown in table 12. The projected rates in table 12 were then applied to projections of post-baccalaureate enrollment to obtain graduate and first-professional enrollment projections by sex and attendance status and by type and control of institution.

Full-Time-Equivalent Enrollment, by Type and Control of Institution and by Level Enrolled

The fifth stage of IFMOD projects full-time-equivalent enrollment by type and control of institution and by level enrolled. For each enrollment category by level enrolled and by type and control of institution, the percentage that the full-time-equivalent of part-time enrollment was of part-time enrollment was projected. Actual percentages for 1980 and projections for 1985 and 1990 are shown in table 12.

These projected percentages were applied to projections of enrollments by level enrolled and by type and control of institution from the fourth stage. The resultant projections of the full-time-equivalent of part-time enrollment were added to projections of full-time enrollment (from the previous stage) to obtain projections of full-time-equivalent enrollment.

Basic Methodology

The notation and equations that follow describe the basic models that were used to project nursery and kindergarten enrollment, elementary and secondary enrollment and higher education enrollment.

Nursery and Kindergarten

For nursery schools and kindergartens, projections were computed separately by sex of student and control of school.

The notation and equation are:

Let:

i = Subscript denoting age

t = Subscript denoting year

E_{it} = Enrollment of students age i

P_{it} = Population age i

R_{it} = Enrollment rate for students age i

T_{it} = Total enrollment for particular subset of students: males and females, by control of school

Then:

$$T_{it} = \sum_{i=3}^{6} E_{it}; \text{ where } E_{it} = R_{it}(P_{it})$$

Elementary and Secondary Enrollment

For elementary and secondary schools, projections were computed separately by control of school. The notation and equations are:

Let:

K_t = Enrollment at the nursery and kindergarten level

G_{jt} = Enrollment in grade j

E_t = Enrollment in elementary special and ungraded programs

S_t = Enrollment in secondary special and ungraded programs

PG_t = Enrollment in post-graduate programs

P_i = Population age i

RK_t = Enrollment rate for nursery and kindergarten

$RG1_t$ = Enrollment rate for grade 1

RE_t = Enrollment rate for elementary special and ungraded programs

RS_t = Enrollment rate for secondary special and ungraded programs

RPG_t = Enrollment rate for post-graduate programs

EG_t = Total enrollment in elementary grades (K-8)

SG_t = Total enrollment in secondary grades (9-12)

R_{jt} = Retention rate for grade j: the proportion that enrollment in grade j in year t is of enrollment in grade j - 1 in year t - 1.

Then:

$$EG_t = K_t + E_t + \sum_{j=1}^{8} G_{jt}$$

$$SG_t = S_t + PG_t + \sum_{j=9}^{12} G_{jt}$$

Where:

$K_t = RK_t(P_5)$

$G_{jt} = R_{jt}(G_{j-1,t-1})$

$$E_t = RE_t\left(\sum_{i=5}^{13} P_i\right)$$

$G_{1t} = RG1_t(P_6)$

$$S_t = RS_t\left(\sum_{i=14}^{17} P_i\right)$$

$PG_t = RPG_t(P_{18})$

Higher Education Enrollment

For institutions of higher education, projections were computed separately by sex and attendance status of student. The notation and equations are:

Let:

i = Subscript denoting age except:

- i = 25; ages 25-29
- i = 26: ages 30-34
- i = 27: ages 35 and over for enrollment and 35 = 44 for population

t = Subscript denoting year

E_{it} = Enrollment of students age i

P_{it} = Population age i

R_{it} = Enrollment rate for students age i

T_{it} = Total enrollment for particular subset of students: full-time men, full-time women, part-time men, part-time women

Then:

$$T_{it} = \sum_{i=16}^{27} E_{it}$$

Where:

$E_{it} = R_{it}(P_{it})$

Methodological Tables

The tables in this section describe the rates used to calculate projections of enrollments (tables 1-13), basic assumptions underlying enrollment projections (table 14) and methods used to estimate values for which data are not available (table 15).

Table 1.–Nursery and kindergarten enrollment rates, by age and sex

Alternative projections	Boys				Girls			
	3 years old	4 years old	5 years old	6 years old	3 years old	4 years old	5 years old	6 years old
1980	30.1	46.9	84.6	11.4	25.8	46.5	83.6	7.2
				Low alternative				
1981-1990	25.6	44.4	83.2	9.2	24.6	44.3	82.2	6.3
				Intermediate alternative				
1985	32.5	48.5	85.0	11.0	28.5	48.0	84.0	7.0
1990	35.0	50.0	85.0	11.0	31.0	49.5	84.0	7.0
				High alternative				
1985	36.0	54.0	85.0	11.0	33.0	55.0	84.0	7.0
1990	45.0	62.0	85.0	11.0	40.0	62.0	84.0	7.0

Table 2.–Elementary enrollment rates, by age and sex

Age	Boys		Girls	
	1980	1981-1990	1980	1981-1990
5	6.6	8.0	9.4	10.0
6	89.7	91.2	94.9	94.3
7	101.2	100.4	101.0	100.5
8	99.5	99.9	100.2	100.5
9	99.0	100.3	99.4	100.7
10	102.4	99.9	102.0	99.8
11	102.0	102.3	102.8	103.1
12	101.4	100.5	101.5	100.2
13	93.4	92.1	90.0	90.5
14	26.9	25.4	18.2	16.2
15	6.3	5.4	3.0	2.7
16	1.2	1.0	0.5	0.4
17	0.2	0.2	0.2	0.2
18	0.1	0.1	0.1	0.1

Table 3.–Secondary enrollment rates, by age and sex

Age	Male		Female	
	1980	1981-1990	1980	1981-1990
12	0.5	0.4	0.2	0.3
13	7.4	7.5	11.1	10.3
14	66.4	70.7	83.2	82.4
15	94.6	92.6	91.3	93.4
16	89.6	91.9	92.2	92.9
17	81.7	79.2	78.4	75.0
18	21.1	20.6	14.2	13.0
19	3.1	3.5	2.6	2.5
20	1.0	1.1	1.9	1.6
21	0.6	0.7	0.9	0.8
22	0.4	0.3	0.7	0.7
23	0.4	0.4	0.4	0.5
24	0.6	0.4	0.4	0.3
25-29	0.3	0.2	0.5	0.4
30-34	0.2	0.2	0.2	0.3

Table 4.–College enrollment rates, alternative projections, by age, sex and attendance status

Age	1980	Low alternative		Intermediate alternative		High alternative	
		1985	1990	1985	1990	1985	1990
Men							
Full-time							
16	0.4	0.4	0.4	0.4	0.4	0.4	0.4
17	3.6	3.4	2.8	4.0	4.0	4.5	4.5
18	26.4	23.9	21.7	26.7	26.7	26.8	27.2
19	30.5	29.1	29.1	29.1	29.1	33.8	37.6
20	25.6	24.6	24.6	24.6	24.6	28.4	31.6
21	25.3	23.8	23.8	23.8	23.8	28.7	32.8
22	15.1	14.6	14.6	14.6	14.6	16.4	17.9
23	9.9	8.1	6.3	10.6	10.6	10.5	10.5
24	8.3	8.2	8.1	8.9	8.9	10.0	10.0
25-29	4.0	3.2	3.0	4.4	4.4	4.6	4.6
30-34	1.5	1.4	1.3	1.6	1.6	1.7	1.7
35-44	0.6	0.6	0.6	0.7	0.7	0.7	0.7
Part-time							
16	–	–	–	–	–	–	–
17	0.6	0.5	0.5	0.5	0.5	0.5	0.5
18	3.1	3.1	3.1	3.1	3.1	3.1	3.1
19	3.7	3.6	3.6	3.4	3.4	4.3	5.0
20	3.6	3.6	3.6	4.0	4.0	3.9	3.9
21	3.5	3.1	2.6	3.8	3.8	4.0	4.0
22	8.3	7.9	7.9	7.6	7.6	9.2	10.4
23	5.4	5.4	5.4	5.5	5.5	5.5	5.5
24	4.6	4.5	4.5	4.6	4.6	4.9	5.3
25-29	6.5	6.5	6.5	6.6	6.6	7.1	7.7
30-34	5.2	5.1	5.1	5.0	5.0	5.6	6.0
35-44	3.4	2.7	2.6	3.7	3.7	3.7	3.7
Women							
Full-time							
16	0.4	0.5	0.5	0.5	0.5	0.5	0.5
17	6.0	5.8	5.4	6.3	6.3	6.4	6.4
18	31.6	31.2	31.2	31.2	31.2	33.4	35.1
19	32.4	30.0	30.0	30.0	30.0	34.6	38.3
20	24.3	23.1	23.1	23.1	23.1	27.5	31.1
21	20.8	20.1	20.1	20.1	20.1	23.4	25.9
22	9.6	8.9	8.9	11.6	13.7	12.0	14.5
23	8.0	7.2	7.2	10.0	12.1	10.7	13.4
24	6.1	5.7	5.7	7.1	8.2	7.6	9.1
25-29	2.4	2.4	2.3	2.8	3.2	3.0	3.3
30-34	1.6	1.4	1.4	1.4	1.4	2.0	2.6
35-44	0.9	0.8	0.8	0.9	0.9	1.0	1.1
Part-time							
16	–	–	–	–	–	–	–
17	0.8	0.7	0.7	0.7	0.7	0.9	1.2
18	4.1	4.0	4.0	4.3	4.6	4.9	5.7
19	4.2	3.9	3.9	3.9	3.9	4.9	5.7
20	5.4	5.1	5.1	5.1	5.1	6.1	6.9
21	4.6	4.4	4.4	4.4	4.4	5.2	5.7
22	8.7	8.2	8.2	8.2	8.2	10.4	12.3
23	7.1	6.7	6.7	6.7	6.7	9.5	11.9
24	5.5	5.2	5.2	5.2	5.2	6.2	7.1
25-29	6.8	6.6	6.6	6.6	6.6	8.7	10.6
30-34	6.1	5.8	5.8	5.8	5.8	8.5	10.9
35-44	6.1	6.0	6.0	6.2	6.2	7.6	8.8

– = Less than 0.1 percent.

Table 5.–Enrollment rates in nursery schools and kindergartens, by age and sex of student, and by control of institution

Sex and year	Public				Private			
	3 years old	4 years old	5 years old	6 years old	3 years old	4 years old	5 years old	6 years old
Males								
1980	8.4	19.8	72.5	10.3	21.8	27.1	12.0	1.2
1985	7.9	19.7	72.1	9.1	19.5	26.1	12.0	1.0
1990	7.9	19.7	72.1	9.1	19.5	26.1	12.0	1.0
Females								
1980	7.1	19.7	71.6	6.5	18.7	26.8	11.9	0.7
1985	7.4	19.6	71.1	6.1	18.2	25.9	11.8	0.7
1990	7.4	19.6	71.1	6.1	18.2	25.9	11.8	0.7

Table 6.–Enrollment rates in public schools

Grade level	Population base age	1980	1985	1990
Regular nursery and kindergarten	5	87.1	87.2	87.2
Grade 1	6	95.6	95.0	95.0
Elementary ungraded and special	5-13	2.9	2.8	2.8
Secondary ungraded and special	14-17	2.6	2.6	2.6
Post-graduate	18	0.4	0.4	0.4

Table 7.–Public grade retention rates

Grade	1980	1985	1990
2	95.5	95.2	95.2
3	100.6	99.7	99.7
4	100.7	100.1	100.1
5	100.2	100.1	100.1
6	99.7	99.9	99.9
7	103.1	103.0	103.0
8	98.9	98.7	98.7
9	106.8	105.0	105.0
10	96.2	95.8	95.8
11	90.8	90.4	90.4
12	90.4	90.1	90.1

Table 8.–Private grade retention rates

Grade	1980*	1985	1990
2	98.1	98.1	98.1
3	98.1	98.1	98.1
4	99.0	99.0	99.0
5	99.5	99.5	99.5
6	99.8	99.8	99.8
7	96.4	96.4	96.4
8	96.8	96.8	96.8
9	84.9	84.9	84.9
10	95.0	95.0	95.0
11	94.8	94.8	94.8
12	94.8	94.8	94.8

*Estimated on data from 1976 to 1978.

Table 9.–Full-time enrollment, by level enrolled and type of institution, as a percentage of total enrollment, for each age and sex classification[1]

Age	Men			Women		
	1980	1985	1990	1980	1985	1990
			Undergraduate, 4-year institutions			
16-17 years old	64.2	63.4	63.4	66.0	62.0	62.0
18-19 years old	64.8	64.9	64.9	65.1	64.0	64.0
20-21 years old	82.9	82.2	82.2	86.1	84.0	84.0
22-24 years old	53.7	52.0	52.0	56.4	55.0	55.0
25-29 years old	36.6	37.0	37.0	42.8	41.0	41.0
30-34 years old	32.1	28.0	28.0	34.7	35.0	35.0
35 years old and over	29.3	25.0	25.0	34.6	34.0	34.0
			Undergraduate, 2-year institutions			
16-17 years old	35.8	36.0	36.0	34.0	38.0	38.0
18-19 years old	35.2	35.2	35.2	34.9	39.0	39.0
20-21 years old	17.1	18.0	18.0	13.9	16.0	16.0
22-24 years old	16.4	18.0	18.0	15.8	19.5	22.0
25-29 years old	16.7	20.0	20.0	26.7	28.0	28.8
30-34 years old	21.6	30.0	30.0	32.6	38.0	40.0
35 years old and over	24.0	30.0	30.0	32.5	38.0	41.0
			Post-baccalaureate, 4-year institutions			
16-17 years old	–	–	–	–	–	–
18-19 years old	–	–	–	–	–	–
20-21 years old	–	–	–	–	–	–
22-24 years old	29.9	27.0	25.0	27.8	26.5	26.5
25-29 years old	46.8	40.2	40.2	30.4	30.0	30.0
30-34 years old	46.3	44.0	44.0	32.8	31.8	31.8
35 years old and over	46.7	44.0	44.0	32.9	32.0	32.0

– = Not applicable.

[1]Projections shown for 1985 and 1990 were adjusted to add to 100 percent before computing projections shown in chapter 1 of *Projections of Education Statistics to 1990-91*, Volume I.

Table 10.—Part-time enrollment, by level enrolled and type of institution, as a percentage of total enrollment, for each age and sex classification[1]

Age	Men			Women		
	1980	1985	1990	1980	1985	1990
			Undergraduate, 4-year institutions			
16-17 years old	37.6	33.6	33.6	20.2	20.5	20.5
18-19 years old	16.1	14.4	14.4	18.2	18.0	18.0
20-21 years old	23.7	24.7	24.7	30.9	32.0	32.0
22-24 years old	32.2	30.0	30.0	31.3	29.0	29.0
25-29 years old	29.6	29.5	29.5	25.6	23.0	23.0
30-34 years old	27.8	28.5	28.5	25.0	22.0	22.0
35 years old and over	27.8	28.0	28.0	25.0	25.0	25.0
			Undergraduate, 2-year institutions			
16-17 years old	55.3	59.9	59.9	74.8	75.6	75.6
18-19 years old	78.0	80.0	80.0	76.8	78.0	78.0
20-21 years old	69.8	75.0	76.0	62.7	67.2	72.1
22-24 years old	52.5	57.9	63.2	55.6	61.0	67.5
25-29 years old	50.0	52.4	56.7	53.7	59.0	63.0
30-34 years old	45.5	46.8	48.7	54.3	60.4	65.0
35 years old and over	45.6	47.3	49.7	54.2	60.0	65.0
			Post-baccalaureate, 4-year institutions			
16-17 years old	7.1	[2]0.0	[2]0.0	5.0	[2]0.0	[2]0.0
18-19 years old	6.0	5.8	5.8	5.0	4.3	4.3
20-21 years old	6.5	6.1	6.1	6.4	6.3	6.3
22-24 years old	15.3	11.9	8.6	13.1	12.0	12.0
25-29 years old	20.4	20.1	17.2	20.6	20.6	20.6
30-34 years old	26.7	26.7	26.7	20.7	18.4	16.9
35 years old and over	26.8	26.0	26.0	20.7	20.7	20.7

[1]Projections shown for 1985 and 1990 were adjusted to add to 100 percent before computing projections shown in chapter 1 of *Projections of Education Statistics to 1990-91*, Volume I.

[2]Projections for 1985 and 1990 are shown as zero because of erratic behavior of the time-series for 16-17-year-olds: percentages periodically returned to near zero or zero values.

Table 11.—Public enrollment as a percentage of total enrollment, by attendance status, sex and level enrolled, and by type of institution

Enrollment category	Men			Women		
	1980	1985	1990	1980	1985	1990
Full-time undergraduate, 4-year institutions	68.8	68.7	68.7	68.6	68.7	68.7
Part-time, undergraduate, 4-year institutions	72.0	71.8	71.8	69.8	69.9	69.9
Full-time, undergraduate, 2-year institutions	92.3	93.0	93.0	89.7	90.2	90.2
Part-time, undergraduate, 2-year institutions	98.7	98.7	98.7	98.7	98.6	98.6
Full-time, post-baccalaureate, 4-year institutions	56.4	56.4	56.4	62.0	62.1	62.1
Part-time, post-baccalaureate, 4-year institutions	60.6	61.0	61.0	71.5	71.9	71.9

Table 12.–Graduate enrollment as a percentage of total post-baccalaureate enrollment, by sex and attendance status, and by type and control of institution

Enrollment category	Men			Women		
	1980	1985	1990	1980	1985	1990
Full-time, 4-year, public	69.4	68.2	66.5	80.6	77.7	74.9
Part-time, 4-year, public	98.8	98.9	98.9	99.4	99.5	99.5
Full-time, 4-year, private	49.5	49.0	48.8	63.5	61.0	58.5
Part-time, 4-year, private	91.4	90.0	90.0	94.8	95.0	95.0

Table 13.–Full-time-equivalent of part-time enrollment as a percentage of part-time enrollment, by level enrolled, and by type and control of institution

Enrollment category	1980	1985	1990
Public, 4-year, undergraduate	37.8	38.7	38.7
Public, 2-year, undergraduate	29.9	31.5	31.5
Private, 4-year, undergraduate	36.2	36.8	36.8
Private, 2-year, undergraduate	38.9	38.5	38.5
Public, 4-year, graduate	35.2	35.5	35.5
Public, 2-year, graduate	...	...	...
Private, 4-year, graduate	36.6	37.0	37.0
Private, 2-year, graduate	...	...	...
Public, 4-year, first-professional	40.0	47.1	47.1
Public, 2-year, first-professional	...	...	...
Private, 4-year, first-professional	38.1	43.0	43.0
Private, 2-year, first-professional	...	...	...

Table 14.–Enrollment (assumptions)

Variables	Assumptions	Alternatives	Tables
Nursery and kindergarten enrollment	Age-specific enrollment rates will remain constant at levels consistent with the most recent rates.	low	5
	Age-specific enrollment rates will increase at a rate proportional to the high alternative.	Intermediate	5
	Age-specific enrollment rates will continue their past trends through 1990.	high	5
Elementary and secondary enrollment	Age-specific enrollment rates will remain constant at levels consistent with the most recent rates.	intermediate (no alternatives)	6, 7
	Public enrollment rates and public grade retention rates will remain constant at levels consistent with the most recent rates.	intermediate (no alternatives)	6, 7
	Private grade retention rates will remain constant at levels consistent with the most recent rates.	intermediate (no alternatives)	6, 7
	The percentage of 7th and 8th grade public students enrolled in schools organized as secondary schools will remain constant at levels consistent with the most recent rates.	intermediate (no alternatives)	7
	Private enrollment by organizational level equals private enrollment by grade group.	intermediate (no alternatives)	7
College full-time and part-time enrollment, by age			
Men	Age-specific enrollment rates will remain constant at levels consistent with the most recent rates.	base	A-1
	Age-specific enrollment rates will remain constant at levels consistent with most recent rates, with the exception of rates that decrease.	low	8-14
	Age-specific enrollment rates for young men enrolled full-time will increase to 1982 and then decrease back to 1980 levels, beginning in 1985 and remain at these levels for the remainder of the decade.	intermediate	8-14
	Age-specific enrollment rates will either equal the intermediate alternative or increase, based on past trends.	high	8-14
Women	Age-specific enrollment rates will remain constant at levels consistent with the most recent rates, with the exception of older women, whose rates will increase slightly.	base	A-1
	Age-specific enrollment rates will remain constant at levels consistent with most recent rates, with the exception of rates that decrease.	low	8-14
	Age-specific enrollment rates for young women enrolled full-time will increase to 1982 and then decrease back to 1980 levels, beginning in 1985, and remain at these levels for the remainder of the decade.	intermediate	8-14
	Age-specific enrollment rates will either equal the intermediate alternative or increase, based on past trends.	high	8-14
College enrollment, by sex, attendance status, and level enrolled by student, and by type of institution	For each group and for each attendance status separately, enrollment by sex and level enrolled by student, and by type of institution as a percentage of total enrollment, will follow past trends through 1990. For each age group and attendance status category, the restriction that the sum of the percentages must equal 100 percent was applied.	high, intermediate, and low	9-14
College enrollment, by control of institution	For each enrollment category, by sex, attendance status, and level enrolled by student, and by type of institution, public enrollment as a percentage of total enrollment will remain constant at levels consistent with most recent rates.	high, intermediate, and low	9-14
Graduate enrollment	For each enrollment category, by sex and attendance status of student, and by type and control of institution, graduate enrollment as a percentage of post-baccalaureate enrollment will follow past trends through 1990.	high, intermediate, and low	11-14
Full-time-equivalent of part-time enrollment	For each enrollment category, by type and control of institution and level enrolled by student, the percentage that full-time equivalent of part-time enrollment is of part-time enrollment will remain constant at levels consistent with the most recent rates.	high intermediate, and low	14

The basic data used to project the time series listed in the following table were wholly or partially estimated for the years indicated.

Table 15.—Enrollment (estimation methods)

Time series	Years	Estimation method	Tables
Enrollment in regular private elementary and secondary schools	1971-75, 1979, 1980	For elementary and secondary schools separately, the percentage that enrollment in Catholic schools was of enrollment in all private schools was interpolated. The interpolated percentages were applied to Catholic enrollment figures in each year.	6, 7
Enrollment in institutions of higher education, by age and attendance status	1970, 1975, 1980	For each sex, enrollment data from the Bureau of the Census by individual ages and by attendance status for 2-year age groups were combined by assuming that within the 2-year age groups, age and attendance status were distributed independently. The resultant enrollment estimates by age and attendance status were then adjusted to NCES enrollment counts by attendance status.	8A, 8B, 8C

Chapter III

High School Graduates and Earned Degrees

High School Graduates

Projections of high school graduates by sex were developed by expressing high school graduates as a percentage of the average of the 17- and 18-year-old populations (table 18). The percentage was assumed to remain constant at levels consistent with the most recent rates throughout the projected period. This constant rate was then applied to projections of the average of the 17- and 18-year-old populations to obtain projections of high school graduates.

Projections of public high school graduates were developed by using graduation rates (table 19) based on projections of enrollment in grade 12 from IFMOD. Public graduation rates were calculated by dividing the number of public high school graduates by the enrollment in grade 12. These graduation rates were then projected and applied to projected enrollment in grade 12 to obtain projections of public high school graduates. Projections of private high school graduates were obtained by subtracting public high school graduates from total high school graduates.

High School Equivalency Credentials

Projections of high school equivalency credentials were developed by expressing high school equivalency credentials, by age, as a percentage of the population, by age (table 20). These percentages were assumed to increase gradually for persons 17 to 29 years old and remain constant for persons 30 years and over.

Degrees

Projections of bachelor's and master's degrees by sex were based on demographic models which relate degree awards to college enrollments by year enrolled and attendance status. Since this type of model produced inadequate results and unrealistic projections for doctor's degrees, a trend model was used to project doctor's degrees by sex.

Bachelor's Degrees

Bachelor's degree projections by sex were based jointly on undergraduate enrollment and fourth-year enrollment by attendance status.[1] For men, a dummy variable was also used representing the change in the direction of the trend in the number of degrees. The percentage that fourth-year college enrollment was of undergraduate enrollment in 4-year institutions was projected using exponential smoothing as the principal forecasting technique (table 21). Projections of fourth-year enrollment were developed by applying these projected percentages to projections of undergraduate enrollment by attendance status.

Results of the regression analysis used to project bachelor's degrees by sex are shown in equations (1) and (2) of table 16. Results for degree alternatives are shown in table 17.

Master's Degrees

The projections of master's degrees by sex were based jointly on total graduate enrollment and first-year graduate enrollment by attendance status. Projections of first-year graduate enrollment were obtained by forecasting the percentage that first-year graduate enrollment is of total graduate enrollment (table 21) and applying these projected percentages to projected graduate enrollment by attendance status. Equations (3) and (4) in table 16 show the results of the regression analysis used to project master's degrees by sex. Equations for degree alternatives are shown in table 17.

Doctor's Degrees

The projections of doctor's degrees were based on the extrapolation of past trends. At the national level, regression models using graduate enrollment variables did not yield reasonable projections. Thus, an extrapolative technique seemed a likely alternative since the numbers of doctors degrees for men had been decreasing and those for women increasing over the past decade. Equations (5) and (6) in table 16 show the results of the trend analysis used to project doctor's degrees by sex.

First-Professional Degrees

Projections of first-professional degrees were determined by adding the individual field projections. First-professional de-

[1] Only full-time enrollment was used in the model.

grees in the health professions were obtained from the Bureau of Health Manpower, Department of Health and Human Services. First-professional degrees in law, theology, pharmacy, chiropractic and "other" fields were developed by NCES (not shown in Volume I). The principal forecasting technique used was exponential smoothing.

Methodological Tables

The tables in this chapter describe equations used to calculate projections (tables 16 and 17), rates used to calculate projections (tables 18-21), and basic assumptions underlying projections (table 22).

The equations used to project degrees by level and sex (table 16 in Volume I) are shown in table 16. The following notation was used in these equations:

BAM = The total number of bachelor's degrees awarded to men.

BAW = The total number of bachelor's degrees awarded to women.

M4F = Full-time fourth-year college enrollment for men, lagged one year.

W4F = Full-time fourth-year college enrollment for women, lagged one year.

MAM = The total number of master's degrees awarded to men.

MAW = The total number of master's degrees awarded to women.

M5F = Full-time first-year graduate enrollment for men, lagged two years.

M5P = Part-time first-year graduate enrollment for men, lagged two years.

W5F = Full-time first-year graduate enrollment for women, lagged two years.

W5P = Part-time first-year graduate enrollment for women, lagged two years.

DOM = The total number of doctor's degrees awarded to men.

DOW = The total number of doctor's degrees awarded to women.

Time = Time trend, 1970 = 1.0.

DMY = Dummy variable representing the change in the direction of the trend in the number of degrees earned by men: 1969-70 to 1973-74 = 0; 1974-75 to 1979-80 = 1

The equations used to project alternatives for bachelor's and master's degrees (table 16 in Volume I) are shown in table 17. The following notation was used in these equations:

Bm = Bachelor's degrees for men

Bw = Bachelor's degrees for women

Mm = Master's degrees for men

Mw = Master's degrees for women

Time = Time trend, 1970 = 1

Table 16.–Equations for bachelor's, master's and doctor's degrees: 1967-1980

	Regression equations	R^2[1]	Durbin-Watson statistic[2]	Regression technique
Bachelor's				
Men	(1) BAM = +218.76 + 0.57M4F – 39.55DMY (3.40) (–2.35)	.82	1.95	Ordinary least squares
Women	(2) BAW = –48.77 + 1.13W4F (6.97)	.82	2.04	Ordinary least squares
Master's				
Men	(3) MAM = –27.93 + 1.16M5F + 0.13M5P (6.75) (0.96)	.92	1.85	Ordinary least squares
Women	(4) MAW = –14.55 + 1.47W5F + 0.11W5P (2.34) (0.50)	.96	.75	Ordinary least squares
Doctor's				
Men	(5) DOM = +28.83 – 0.48TIME (–4.12)	.65	.64	Ordinary least squares
Women	(6) DOW = +3.66 + 0.56TIME (29.35)	.99	1.06	Ordinary least squares

[1] R^2 = Coefficient of determination.

[2] For an explanation of the Durbin-Watson Statistic, see J. Johnston, *Econometric Methods*, New York: McGraw Hill, 1972, pages 251-252.

NOTE: The numbers in parentheses refer to the value of the t-statistics.

Table 17.–Equations for alternatives of bachelor's and master's degrees

Exponential smoothing equations

Dependent variable	Equation (t = 0 in 1981)	MAD[1]	Smoothing constant
Bachelor's degrees for men (low alternative)	Bm = 469.46 – 6.58t	12.53	0.60
Master's degrees for men (low alternative)	Mm = 153.95 – 2.78t	6.11	0.50
Master's degrees for women (high alternative)	Mw = 156.45 + 2.91t	8.21	0.45

Regression equation (ordinary least squares)

Dependent variable	Equation	R^2[2]	Durbin-Watson Statistics[3]
Bachelor's degrees for women (high alternative)	Bw = +351.24 + 9.81Time (9.10)	.90	0.53

[1] MAD = Mean absolute deviation.

[2] R^2 = Coefficient of determination.

[3] For an explanation of the Durbin-Watson Statistic, see J. Johnston, *Econometric Methods*, New York: McGraw Hill, 1972, pages 251-252.

NOTE: The numbers in parentheses refer to the value of the t-statistics.

Table 18.–High school graduates as a percentage of the average of the 17- and 18-year-old population, by sex

Year	Boys	Girls
1974	71.9	76.5
1976	72.4	76.7
1978	71.2	76.6
1980	71.1	76.1
1981-1991	71.3	76.6

Table 19.–High school graduates as a percentage of enrollment in grade 12 in public schools

Year	Graduation rate (percent)
1974	95.1
1976	95.2
1978	93.4
1980	93.1
1981-1991	93.3

Table 20.–High school equivalency credentials as a percentage of population, by age group

Age	1980	1986	1991
17-19	1.3	1.7	2.0
20-24	0.6	0.7	0.8
25-29	0.3	0.3	0.4
30-34	0.2	0.2	0.2
35-39	0.2	0.2	0.2
40-54*	0.1	0.1	0.1

*Includes persons 55 and over; however, counts are small.

Table 21.–Enrollment percentages, by year enrolled, attendance status, and sex

Year enrolled	Men			Women		
	1980	1985	1990	1980	1985	1990
Fourth-year undergraduate enrollment as a percent of total undergraduate enrollment in 4-year institutions[1]						
Full-time	20.8	23.2	22.3	20.0	25.7	25.2
First-year graduate enrollment as a percent of total graduate enrollment						
Full-time	[2]44.8	45.0	45.0	[2]48.5	50.0	50.0
Part-time	[2]41.9	42.0	42.0	[2]44.0	44.0	44.0

[1]Projections for 1985 and 1990 have been adjusted to agree with numbers in table A-5.

[2]Estimated.

Table 22.–Graduates and degrees (assumptions)

Variables	Assumptions	Alternatives	Tables
High school graduates, by by sex	The percentage that high school graduates is of the average of the 17- and 18-year-old population will remain constant at levels consistent with the most recent rates.	intermediate (no alternatives)	15
Public high school graduates	The percentage that public high school graduates is of public enrollment in grade 12 will remain constant at levels consistent with the most recent observations.	intermediate (no alternatives)	15
Private high school graduates	The number of private high school graduates will equal total high school graduates, minus public high school graduates.	intermediate (no alternatives)	15
High school equivalency credentials, by age	The percentage that high school equivalency credentials by age is of population by age will increase, based on past trends, for persons who are 17 to 29 and remain constant for persons 30 years and over.	intermediate (no alternatives)	15
Full-time, fourth-year college enrollment (men)	The percentage that full-time, fourth-year college enrollments is of full-time undergraduate college enrollment in 4-year institutions will increase, based on past trends.	intermediate	16
Full-time, fourth-year college enrollment (women)	The percentage that full-time, fourth-year college enrollment is of full-time undergraduate college enrollment in 4-year institutions will increase, based on past trends.	intermediate	16
Full-time, first-year graduate enrollment, by sex	The percentage that full-time, first-year graduate enrollments is of full-time graduate enrollment will remain constant at levels consistent with most recent rates.	intermediate	16
Part-time, first-year graduate enrollment, by sex	The percentage that part-time, first-year graduate enrollment is of part-time graduate enrollment will remain constant at levels consistent with most recent rates.	intermediate	16
Bachelor's degrees (men)	The number of bachelor's degrees awarded to men is a linear function of full-time, fourth-year enrollment and a dummy variable representing the change in the direction of the trend in the number of degrees.	intermediate	16
	The number of bachelor's degrees will decrease, based on past trends.	low	16
	The number of bachelor's degrees will equal twice the intermediate alternative, minus the low alternative.	high	16
Bachelor's degrees (women)	The number of bachelor's degrees awarded to women is a linear function of full-time, fourth-year enrollment. Relationship will continue through 1990-91.	intermediate	16
	The number of bachelor's degrees will increase, based on past trends.	high	16
	The number of bachelor's degrees will equal twice the intermediate alternative, minus the high alternative.	low	16
Master's degrees (men)	The number of master's degrees is a linear function of first-year graduate enrollment, by attendance status. This relationship will continue through 1990-91.	intermediate	16
	The number of master's degrees will decrease, based on past trends.	low	16
	The number of master's degrees will equal twice the intermediate alternative, minus the low alternative.	high	16
Master's degrees (women)	The number of master's degrees is a linear function of first-year graduate enrollment, by attendance status. This relationship will continue through 1990-91.	intermediate	16
	The number of master's degrees will increase, based on past trends.	high	16
	The number of master's degrees will equal twice the intermediate alternative, minus the high alternative.	low	16
Doctor's degrees (men)	The number of doctor's degrees will decrease, based on past trends.	intermediate	16
	The number of doctor's degrees will remain constant at the 1980 level.	high	16
	The number of doctor's degrees will equal twice the intermediate alternative, minus the high alternative.	low	16

Table 22.–Graduates and degrees (assumptions)–Cont.

Variables	Assumptions	Alternatives	Tables
Doctor's degrees (women)	The number of doctor's degrees will increase, based on past trends.	intermediate	16
	The number of doctor's degrees will remain constant at the 1980 level.	low	16
	The number of doctor's degrees will equal twice the intermediate alternative, minus the low alternative.	high	16
First-professional degrees, by sex	Projections of degrees in medicine, dentistry, osteopathic, optometry, podiatry, and veternary medicine were obtained from Bureau of Health Manpower, Department of Health and Human Services.	low, intermediate, high	16
	The total number of degrees in law, theology, chiropratic and pharmacy will be constant at levels consistent with most recent observations.	intermediate	16
	The total number of degrees in law, theology, chiropratic and pharmacy will increase, based on past trends.	high	16
	The total number of degrees in law, theology, chiropratic, and pharmacy will equal twice the intermediate alternative, minus the high alternative.	low	16

Chapter IV

Instructional Staff

Classroom Teachers

In Volume I, projections of classroom teachers in regular elementary and secondary schools (table 17) are based on the enrollment projections by organizational level (table 7) and the alternative projections of teacher-pupil ratios shown in table 18.

Teacher-pupil ratios are used in this edition instead of pupil-teacher ratios. This change was made because for a given enrollment, the conditional distribution of teacher-pupil ratios is linear, whereas the conditional distribution of pupil-teacher ratios is hyperbolic.

The impact of this can be illustrated for a given 1,000 pupils, 0.6 additional teachers are required to reduce the pupil-teacher ratio from 40 to 39, but 2.6 additional teachers are required to reduce the ratio from 20 to 19. In fact, it requires slightly fewer additional teachers to reduce the pupil-teacher ratio from 40 to 35 than from 17 to 16. In contrast, an equal movement at any two points of the range of teacher-pupil ratios requires an equal number of teachers. Converting to teachers per thousand pupils for ease of interpretation, it takes one additional teacher to increase this ratio from 39 to 40 and from 19 to 20.

Estimates and projections of the demand for additional teachers in regular public elementary and secondary schools were computed as follows: (1) the number of additional teachers needed for pupil-teacher ratio changes was computed as the difference between the total teacher demand in a given year, less the estimated total teacher demand in the same year had the pupil-teacher ratio in the previous year remained constant; (2) the number of additional teachers needed for enrollment changes was computed as the difference between the total teacher demand in a given year and the total teacher demand in the previous year, less the computed number needed for pupil-teacher ratio changes in the given year; and (3) the number of additional teachers needed in a given year to replace those leaving public schools either temporarily or permanently was computed as a percentage of the total number of teachers employed in the previous year. Estimates and projections of the demand for additional teachers in regular nonpublic elementary and secondary schools are projected in the same manner as for public schools.

Projections of the supply of new teacher graduates were computed as percentages of the intermediate alternative bachelor's degree projections in table 16, Volume I.

Higher Education Instructional Staff

Projections of full-time instructional staff in institutions of higher education are based on alternative projections of full-time-equivalent enrollment, by type and control of institution (table 14 in Volume I) and constant projections of student staff ratios (full-time-equivalent enrollment to full-time-equivalent instructional staff), by type and control of institution.

Full-time equivalent instructional staff was separated by rank and by full-time and part-time status on the bases of the 1976 distribution of these attributes. Projections of the demand for additional full-time-equivalent instructional staff were computed in the following manner: (1) the numbers needed for enrollment changes and student-staff ratio changes were computed as the difference between the total full-time-equivalent professional staff in two successive years; and (2) the numbers needed for replacement of those leaving the profession, either permanently or temporarily, was estimated as a percent of the total full-time-equivalent instructional staff in the previous year.

Basic Methodology

The notation and equations that follow describe the basic models that were used to project classroom teachers and instructional staff. For elementary and secondary schools, projections were computed separately by control and organizational level of school. For institutions of higher education, projections were computed separately by type (4-year and 2-year) and control of institution.

Classroom Teachers

Let:
t = Subscript denoting year

E_t = Enrollment

T_t = Classroom teachers

TP_t = Teachers per thousand pupils

A_t = Total demand for additional teachers

AE_t = Additional teachers needed for enrollment changes

AT_t = Additional teachers needed for teacher-pupil ratio changes

AR_t = Additional teachers needed for replacement (turnover) of teachers

R_t = Replacement (turnover) rate

Then:

$T_t = E_t(TP_t)/1{,}000$

and

$A_t = AE_t + AT_t + AR_t$

Where:

$AT_t = T_t - E_t(TP_{t-1})/1{,}000$

$AE_t = T_t - T_{t-1} - AT_t$

$AR_t = R_t(T_{t-1})$

Higher Education Instructional Staff

Let:

FE_t = Full-time-equivalent enrollment in institution of higher education

FI_t = Full-time-equivalent instructional staff

EI_t = Ratio of full-time-equivalent enrollment to full-time-equivalent staff (student-staff ratio)

AI_t = Total demand for additional full-time-equivalent staff

AEI_t = Additional full-time-equivalent staff needed for enrollment and student-staff ratio changes

ARI_t = Additional full-time-equivalent staff needed for replacement

RI_t = Replacement rate

Then:

$FI_t = E_t/EI_t$

and

$AI_t = AEI_t + ARI_t$

Where:

$AEI_t = FI_t - FI_{t-1}$

$ARI_t = RI_t(FI_{t-1})$

Methodological Tables

The tables in this chapter describe: equations used to calculate projections (table 23), rates used to calculate projections (tables 24-27), basic assumptions underlying projections (table 28), and methods used to estimate values for which data are not available (table 29).

The equations used to project teacher-pupil ratios and the supply of new teacher graduates are shown in table 23. The following notation was used in these equations:

TP = Teacher-pupil ratio

PCI = Per capita income (adjusted to 1980-81 dollars)

ENRD = The absolute value of annual enrollment declines (0 for increases)

H = Dummy variable representing the enactment of the Education of All Handicapped Children Act

NTG = Number of new graduates qualified to teach

A = Demand for additional teachers

TS = Average annual salary of classroom teachers

t = Time in years: 1981 = 0

Table 23.–Equations for classroom teachers

Dependent variable	Regression equations (ordinary least squares) Equation	$\bar{R}^2$[1]	Durbin-Watson[2] statistic
Teacher-pupil ratio in public elementary schools (low alternative)	ln TP = –0.817 + 0.503 ln PCI + 0.007 ln ENRD + 0.066 ln H (15.02) (3.12) (4.48)	0.972	1.107
Teacher-pupil ratio in public secondary schools (low alternative)	ln TP = 1.472 + 0.274 ln PCI + 0.079 ln H (10.45) (5.30)	0.914	1.176
New teacher graduates as a percentage of bachelor's degrees (intermediate alternative)	ln NTG = 7.177 + 1.172 ln A – 1.918 ln TS	0.781	1.080

Exponential smoothing equations

Dependent variable	Equation (t = 0 in 1981)	MAD[3]	Smoothing constant
Teacher-pupil ratio in public elementary schools (high alternative)	TP = 49.84 + 0.78t	0.88	0.2
Teacher-pupil ratio in public secondary schools (high alternative)	TP = 59.11 + 0.73t[4]	0.907	0.2
Teacher-pupil ratio in private elementary schools (high alternative)	TP = 50.94 + 0.62t	0.659	0.2
Teacher-pupil ratio in private secondary schools (high alternative)	TP = 66.24 + 0.53t	2.080	0.4
New teacher graduates as a percentage of bachelor's degrees	NTG = 16.32 – 0.80t	0.824	0.6

[1] $\bar{R}^2$ = Adjusted coefficient of determination.

[2] For an explanation of the Durbin-Watson Statistic, see J. Johnston, *Econometric Methods*, New York: McGraw Hill, 1972, pages 251-252.

[3] MAD = Mean absolute deviation.

[4] Values for 1981 and 1982 were adjusted to agree with the actual value for 1980.

NOTE: The numbers in parentheses refer to the value of the t-statistics.

Table 24.–Replacement (turnover) rates for classroom teachers in regular elementary and secondary schools

Year	Low alternative	Intermediate alternative	High alternative
		Estimated	
1971	–	[1]7.0	–
1972	–	[1]6.5	–
1973	–	6.0	–
1974	–	6.0	–
1975	–	6.0	–
1976	–	6.0	–
1977	–	6.0	–
1978	–	6.0	–
1979	–	6.0	–
1980	–	6.0	–
		Projected	
1981	5.5	6.0	6.5
1982	5.0	6.0	7.0
1983	4.8	6.0	7.5
1984	4.8	6.0	8.0
1985	4.8	6.0	8.0
1986	4.8	6.0	8.0
1987	4.8	6.0	8.0
1988	4.8	6.0	8.0
1989	4.8	6.0	8.0
1990	4.8	6.0	8.0

[1]A 6 percent rate was used for private schools.

Table 25.–New teacher graduates as a percentage of bachelor's degrees

Year	Low alternative	Intermediate alternative	High alternative
1970	–	35.8	–
1971	–	37.4	–
1972	–	35.7	–
1973	–	33.9	–
1974	–	29.5	–
1975	–	25.8	–
1976	–	24.0	–
1977	–	21.1	–
1978	–	19.7	–
1979	–	17.7	–
1980	–	17.1	–
		Projected	
1981	16.3	16.7	17.1
1982	15.5	16.3	18.2
1983	14.7	15.9	18.8
1984	13.9	15.5	19.3
1985	13.1	15.1	19.9
1986	13.9	17.2	20.5
1987	14.7	19.3	23.9
1988	15.5	21.4	27.3
1989	16.3	23.5	30.7
1990	17.1	25.6	34.1

Table 26.–Ratios and percents used to project total and full-time-equivalent faculty

Type and control of institution	Student-staff ratio	Percentage of senior full-time-equivalent faculty	Percentage of senior full-time-equivalent faculty that is full-time	Percentage of junior full-time-equivalent faculty that is full-time	Full-time-equivalent percentage of senior part-time faculty	Full-time-equivalent percentage of junior part-time faculty
Public 4-year	12.4	81.2	92.2	28.2	37.8	41.0
Public 2-year	22.5	97.2	76.0	72.4	29.6	34.0
Private 4-year	11.8	87.7	85.1	46.2	34.4	44.5
Private 2-year	17.9	98.5	73.1	([1])	37.8	([1])

[1]Junior faculty is negligible in private 2-year institutions.

Table 27.–Replacement rates for full-time-equivalent instructional staff in institutions of higher education

Year	Low alternative	Intermediate alternative	High alternative
		Estimated	
1971	–	4.5	–
1972	–	4.5	–
1973	–	4.5	–
1974	–	4.5	–
1975	–	4.5	–
1976	–	4.5	–
1977	–	4.5	–
1978	–	4.5	–
1979	–	4.5	–
1980	–	4.5	–
		Projected	
1981	4.5	4.5	5.0
1982	4.5	4.5	5.5
1983	4.5	4.5	6.0
1984	4.5	4.5	6.0
1985	4.5	4.5	6.0
1986	4.5	4.5	6.0
1987	4.5	4.5	6.0
1988	4.5	4.5	6.0
1989	4.5	4.5	6.0
1990	4.5	4.5	6.0

Table 28.–Instructional staff (assumptions)

Variables	Assumptions	Alternatives	Tables
Classroom teachers in regular public elementary schools	The natural logarithm of teacher-pupil ratios is a linear function of the natural logarithms of per capita income, enrollment declines, and a dummy variable representing the Handicapped Education Act. This functional relationship will continue through 1990.	low	17, 18
	Teacher-pupil ratios will continue increasing, based on past trends.	high	17, 18
	Teacher-pupil ratios will equal the average of the high and low alternative ratios.	intermediate	17, 18
Classroom teachers in regular public secondary schools	The natural logarithm of teacher-pupil ratios is a linear function of the natural logarithm of per capita income and a dummy variable representing the Handicapped Education Act. This functional relationship will continue through 1990.	low	17, 18
	Teacher-pupil ratios will continue increasing, based on past trends.	high	17, 18
	Teacher-pupil ratios will equal the average of the high and low alternative ratios.	intermediate	17, 18
Classroom teachers in regular private elementary and secondary schools	Teacher-pupil ratios will remain constant at the average of the 1977 through 1980 rates.	low	17, 18
	Teacher-pupil ratios will continue increasing, based on past trends.	high	17, 18
	Teacher-pupil ratios will equal the average of the high and low alternatives ratios.	intermediate	17, 18
Demand for additional teachers in regular schools due to replacement	Replacement (turnover) rates will return to the historic level of 8 percent.	high	19
	Replacement (turnover) rates will remain at the currently estimated level of 6 percent.	intermediate	19
	Replacement (turnover) rates will decrease to a theoretical floor of 4.8 percent.	low	19
Supply of new teacher graduates	The percentage that new teacher graduates are of bachelor's degree recipients will decrease through 1985 based on past trends. From 1986 through 1990 the percentage will increase back to the 1980 level.	low	21
	The natural logarithm of the percentage that new teacher graduates are of bachelor's degree recipients is a linear function of the natural logarithm of the demand for additional teachers and teachers' salaries. This functional relationship will continue through 1990.	intermediate	21
	The percentage that new teacher graduates are of bachelor's degree recipients will equal twice the intermediate alternative, minus the low alternative.	high	21
Full-time-equivalent instructional staff in institutions of higher education	For each type and control of institution, the ratio of full-time-equivalent enrollment to full-time-equivalent instructional staff will remain constant at 1976 levels.	high, intermediate, and low	23, 24
Full-time-equivalent senior instructional staff	For each type and control of institution, the percentage that senior full-time-equivalent instructional staff is of total full-time-equivalent instructional staff will remain constant at 1976 levels.	high, intermediate, and low	23, 24
Full-time senior instructional staff	For each type and control of institution, the percentage that full-time senior instructional staff is of full-time-equivalent senior instructional staff will remain constant at 1976 levels.	high, intermediate, and low	22, 23
Part-time senior instructional staff	For each type and control of institution, the percentage that full-time-equivalent senior part-time instructional staff is of senior part-time instructional staff will remain constant at 1976 levels.	high, intermediate, and low	22
Full-time junior instructional staff	For each type and control of institution, the percentage that full-time junior instructional staff is of full-time-equivalent junior instructional staff will remain constant at 1976 levels.	high, intermediate, and low	22, 23
Part-time junior instructional staff	For each type and control of institution, the percentage that full-time-equivalent part-time instructional staff is of junior part-time instructional staff will remain constant at 1976 levels.	high, intermediate, and low	22

Table 28.–Instructional staff (assumptions)–Cont.

Variables	Assumptions	Alternatives	Tables
Demand for additional full-time-equivalent instructional staff due to replacement	Replacement rates will remain at the currently estimated level of 4.5 percent.	intermediate and low	24
	Replacement rates will increase back to the 1959-60 level of 6.0 percent.	high	24

Table 29.–Instructional staff (estimation methods)

Time series	Years	Estimation method	Tables
Classroom teachers in regular private elementary and secondary schools	1969, 1971-75 and 1979	For elementary and secondary separately, pupil-teacher ratios were interpolated. The interpolated ratios were applied to estimates of private enrollment in each year.	18
Classroom teachers in regular public elementary and secondary schools, by organizational level	1971-80	The numbers of elementary and secondary teachers reported separately by the National Education Association were prorated to the NCES totals for each year.	18
Full-time-equivalent instructional staff	1968, 1969, 1971 and 1973-75	For each type and control of institution, the ratio of full-time-equivalent enrollment to full-time-equivalent instructional staff was interpolated. The interpolated ratios were applied to counts of full-time-equivalent enrollment for each year.	23
	1977-80	Same methodology as above, with 1976 ratios held constant.	23
Full-time-equivalent senior instructional staff	1968, 1969, 1971 and 1973-75	For each type and control of institution, the percentage that full-time-equivalent senior instructional staff was of total full-time-equivalent instructional staff was interpolated. The interpolated percentages were applied to estimates of full-time-equivalent instructional staff for each year.	23
	1977-80	Same methodology as above, with 1976 percentages held constant.	23
Full-time senior instructional staff	1968, 1969, 1971 and 1973-75	For each type and control of institution, the percentage that full-time senior instructional staff was of full-time-equivalent senior instructional staff was interpolated. This percentage was applied to estimates of full-time-equivalent senior instructional staff for each year.	22, 23
	1977-80	Same methodology as above, with 1976 percentages held constant.	22, 23
Part-time senior instructional staff	1968, 1969, 1971 and 1973-75	For each type and control of institution, the percentage that the full-time-equivalent of part-time senior instructional staff was interpolated. This percentage was applied to estimates of part-time senior instructional staff for each year.	22
	1977-80	Same methodology as above, with 1976 percentage held constant.	22
Full-time junior instructional staff	1968, 1969, 1971 and 1973-75	For each type and control of institution, the percentage that full-time junior instructional staff was of full-time-equivalent junior instructional staff was interpolated. This percentage was applied to estimates of full-time-equivalent junior instructional staff.	22, 23
	1977-80	Same methodology as above, with 1976 percentages held constant.	22, 23
Part-time junior instructional staff	1968, 1969, 1971 and 1973-75	For each type and control of institution, the percentage that the full-time-equivalent of part-time senior instructional staff was of part-time senior instructional staff was interpolated. This percentage was applied to estimates of part-time senior instructional staff for each year.	22
	1977-80	Same methodology as above, with 1976 percentages held constant.	22

Chapter V

Expenditures

Elementary and Secondary Schools

Projections of current expenditures in regular public elementary and secondary schools are computed as the sum of current expenditures for teachers' salaries and all other current expenditures. Projections of current expenditures for teachers' salaries are based on the projections of average annual salaries of classroom teachers shown in table 28 and the projections of teachers shown in table 17. Other current expenditures were projected on a per-pupil-in-average-daily-attendance (ADA) basis. Public ADA was projected as 92 percent of the projected enrollment in table 6.

Current expenditures in private elementary and secondary schools are estimated and projected on the basis of the ratio of public enrollment to private enrollment. Since expenditure data for private schools are not available, these estimates and projections simply illustrate what it would cost the public schools to educate the students enrolled in private schools.

This procedure was also used to project capital outlay and interest expenditures in private schools. The projections of these expenditures in public schools are based primarily on extrapolations of past trends, projections of enrollment, and the projections of nonrevenue receipts in table A-8.

Institutions of Higher Education

Projections of current expenditures in institutions of higher education are based on projections of current expenditures for student education per full-time equivalent (FTE). These ratios were applied to projections of FTE in tables 14A and 14B. This procedure was carried out separately for private institutions, public 4-year institutions and public 2-year institutions. Capital outlay was also projected separately for each of these three institutional categories.

Basic Methodology

The notation and equations below describe the basic models used to project current expenditures in elementary and secondary schools and in institutions of higher education.

Elementary and Secondary Schools

Let:

C_t = Total current expenditures

TC_t = Current expenditures for teachers' salaries

OC_t = Other current expenditures (not for teachers' salaries)

T_t = Number of classroom teachers

S_t = Average annual salary of classroom teachers

A_t = Average daily attendance

RA_t = Other current expenditures per ADA

Then:

$$C_t = TC_t + OC_t$$

Where:

$$TC_t = T_t(S_t)$$

$$OC_t = RA_t(A_t)$$

Institutions of Higher Education

Let:

CE_t = Total current expenditures

CG_t = Educational and general current expenditures

CS_t = Student education current expenditures

RF_t = Student education current expenditures per full-time-equivalent student

F_t = Full-time-equivalent enrollment

PE_t = Percentage that educational and general current expenditures are of total expenditures

PC_t = Percentage that total current expenditures are of educational and general current expenditures

Then:

$CE_t = CG_t/PC_t$

Where:

$CG_t = CS_t/PE_t$

$CS_t = RF_t(F_t)$

Methodological Tables

The tables in this chapter describe equations used to calculate projections (table 30), rates used to calculate projections (table 31), basic assumptions underlying projections (table 32), and methods used to estimate values for which data are not available (table 33).

The equations in table 30 were used to project current expenditures, average teachers' salaries, capital outlay and interest expenditures in public elementary and secondary schools. The following notation was used in these equations:

S = Average annual salaries of classroom teachers

I = Interest expenditures

PCI = Per capita income

D = Demand for additional teachers

NR = Nonrevenue receipts (average for the previous 5 years)

E = Total enrollment in regular public elementary and secondary schools

CO = Capital outlay

RA = Other current expenditures (not for teachers' salaries) per ADA

Table 30.–Equations for expenditures

Dependent variable	Regression equations (ordinary least squares) Equation	$\bar{R}^2$[1]	Durbin-Watson[2] Statistic
Average annual salaries of classroom teachers in regular public schools, in 1980-81 dollars (high alternative)	$\ln S = 2.996 + 0.600 \ln PCI + 0.265 \ln D$ (5.12) (3.85)	0.590	0.905
Interest expenditure by regular public schools, in millions of current dollars (low alternative)	$\ln I_t = 14.498 + 2.020 \ln NR_{t-4} + 1.464 \ln E_{t-4}$ (6.92) (3.50)	0.968	0.626
Capital outlay by public schools, in millions of 1980-81 dollars (high alternative)	$\ln CO = -11.013 + 5.301 \ln E$ (7.50)	0.862	1.156

Exponential smoothing (t = 0 in 1981)

Dependent variable	Equation	Smoothing constant	MAD[3]
Nonrevenue receipts (5-year average) in millions of current dollars	$NR = 4,316 + 124t$	0.4	94
Capital outlay by public schools, in millions of current dollars (low alternative)	$CO = 6,143 + 138T$	0.2	462
Other current expenditures per ADA, in 1980-81 dollars	$RA = 1,629 + 50t$	0.2	77

[1] $\bar{R}^2$ = Adjusted coefficient of determination.

[2] For an explanation of the Durbin-Watson Statistic, see J. Johnston, *Econometric Methods*, New York: McGraw Hill, 1972, pages 251-252.

[3] MAD = Mean absolute deviation.

NOTE: The numbers in parentheses refer to the value of the t-statistics.

Table 31.–Ratios and percentages used to project current expenditures and capital outlay in institutions of higher education

Institutional type	Current expenditures per full-time-equivalent student	Current expenditures for student education as a percentage of educational and general current expenditures	Educational and general current expenditures as a percentage of total current expenditures	Capital outlay full-time-equivalent student
Total public	–	80.7	82.0	–
Public 4-year	$5,038	–	–	$843
Public 2-year	2,856	–	–	394
Total private	5,627	76.4	73.2	856

Table 32.–Expenditures (assumptions)

Variable	Assumptions	Alternatives	Tables
Average annual salary of classroom teachers, in 1980-81 dollars	Salaries will remain at the approximate 1980-81 salary.	low	27, 28
	The natural logarithm of salaries is a linear function of the natural logarithm of per capita income and the natural logarithm of demand for additional teachers. The functional relationship will continue through 1990-91.	high	
	Salaries will equal the average of the high and low alternative projections.	intermediate	
Current expenditures by public schools, in 1980-81 dollars	Other current expenditures (not for teachers' salaries) per ADA will continue increasing, based on past trends.	high	27
	Other current expenditures per ADA will remain constant at its 1980-81 level.	low	
	Other current expenditure per ADA will equal the average of the high and low alternative projections.	intermediate	
Capital outlay by public schools	The natural logarithm of capital outlay in 1980-81 dollars is a linear function of the natural logarithm of enrollment. The functional relationships will continue through 1990-91.	high	30
	Capital outlay in current dollars will continue increasing based on past trends.	low	
	Capital outlay in 1980-81 dollars will equal the average of the high and low alternative projections.	intermediate	
Interest expenditures by public schools	The natural logarithm of interest expenditures in current dollars is a linear function of the natural logarithm of nonrevenue receipts, 4 years earlier, and the natural logarithm of enrollment, 4 years earlier. The functional relationship will continue through 1990-91.	low	29
	Interest expenditures in 1980-81 dollars will remain constant at the 1980-81 level.	high	
	Interest expenditures in 1980-81 dollars will equal the average of the high and low alternative projections.	intermediate	
	The 5-year average of nonrevenue receipts in current dollars will continue increasing, based on past trends.	low	
Expenditures by private schools	Current expenditures, capital outlay, and interest expenditures of private schools will be in the same ratio to their respective public expenditures as the ratio of projected private school enrollment is to projected public school enrollment.	high, intermediate, and low	25, 26

Table 33.–Expenditures (estimation methods)

Variable	Years	Estimation method	Tables
Private expenditures	1970-71 through 1980-81	Current expenditures, capital outlay, and interest expenditures were estimated to be in the same ratio to their respective public expenditures as private enrollment was to public enrollment.	25, 26
Current expenditures	1979-80	Estimates from the National Education Association (NEA) were adjusted on the basis of the past relationship between NEA estimates and NCES reported data.	27

Appendix A

Statistical Tables

Table A-1.–School-age populations, boys, by individual ages 3-15 years: 50 States and D.C., as of July 1, 1970 to 1990

(In thousands)

Year (fall)	3 years old	4 years old	5 years old	6 years old	7 years old	8 years old	9 years old	10 years old	11 years old	12 years old	13 years old	14 years old	15 years old
1970	1,733	1,810	1,912	2,009	2,046	2,053	2,121	2,172	2,104	2,127	2,124	2,086	2,060
1971	1,695	1,758	1,808	1,918	2,018	2,022	2,080	2,206	2,099	2,120	2,127	2,164	2,085
1972	1,717	1,719	1,756	1,814	1,927	1,994	2,047	2,163	2,132	2,114	2,119	2,166	2,161
1973	1,759	1,741	1,717	1,762	1,823	1,904	2,020	2,130	2,090	2,147	2,113	2,159	2,164
1974	1,802	1,783	1,738	1,722	1,770	1,800	1,928	2,101	2,057	2,105	2,146	2,153	2,157
1975	1,645	1,827	1,782	1,744	1,731	1,749	1,824	2,007	2,031	2,073	2,106	2,188	2,153
1976	1,553	1,669	1,827	1,788	1,753	1,711	1,772	1,899	1,940	2,046	2,074	2,146	2,187
1977	1,518	1,574	1,668	1,832	1,796	1,732	1,732	1,844	1,834	1,954	2,045	2,113	2,144
1978	1,554	1,541	1,576	1,675	1,842	1,776	1,755	1,805	1,783	1,850	1,955	2,086	2,113
1979	1,528	1,516	1,541	1,581	1,683	1,820	1,799	1,828	1,744	1,797	1,850	1,993	2,085
1980[1]	1,567	1,559	1,581	1,548	1,590	1,663	1,843	1,873	1,766	1,757	1,797	1,886	1,992
							Projected						
1981	1,615	1,590	1,560	1,587	1,556	1,571	1,685	1,920	1,810	1,779	1,758	1,832	1,885
1982	1,682	1,639	1,591	1,566	1,595	1,539	1,592	1,756	1,855	1,854	1,780	1,793	1,832
1983	1,764	1,707	1,641	1,597	1,574	1,577	1,559	1,660	1,697	1,869	1,824	1,815	1,793
1984	1,842	1,789	1,708	1,647	1,606	1,556	1,598	1,626	1,604	1,710	1,870	1,860	1,816
1985	1,895	1,868	1,790	1,715	1,655	1,587	1,577	1,666	1,570	1,617	1,711	1,907	1,861
1986	1,928	1,922	1,869	1,797	1,723	1,636	1,608	1,644	1,609	1,584	1,616	1,745	1,907
1987	1,952	1,955	1,923	1,875	1,805	1,703	1,658	1,676	1,588	1,623	1,584	1,650	1,746
1988	1,969	1,979	1,956	1,929	1,884	1,784	1,725	1,727	1,619	1,601	1,623	1,616	1,652
1989	1,981	1,997	1,980	1,962	1,938	1,862	1,807	1,797	1,668	1,632	1,601	1,655	1,618
1990	1,987	2,008	1,997	1,986	1,971	1,914	1,885	1,882	1,736	1,681	1,632	1,633	1,657

[1]Projected.

Table A-2.–College-age populations, men, by individual ages and age groups 16-34 years: 50 States and D.C., as of July 1, 1970 to 1990
(In thousands)

Year (fall)	16 years old	17 years old	18 years old	19 years old	20 years old	21 years old	22 years old	23 years old	24 years old	25-29 years old	30-34 years old	Total 18-24 years old	Total 25-34 years old
1970	1,999	1,956	1,913	1,879	1,847	1,799	1,755	1,858	1,387	6,811	5,710	12,431	12,521
1971	2,040	2,003	1,958	1,927	1,919	1,793	1,752	1,717	1,911	6,941	5,858	12,977	12,799
1972	2,063	2,043	2,005	2,973	1,969	1,865	1,748	1,715	1,767	7,512	6,075	13,041	13,587
1973	2,139	2,066	2,045	2,020	2,016	1,913	1,818	1,712	1,766	7,754	6,441	13,290	14,195
1974	2,142	2,143	2,069	2,060	2,064	1,958	1,864	1,779	1,761	8,083	6,694	13,555	14,777
1975	2,136	2,147	2,146	2,085	2,106	2,006	1,909	1,826	1,832	8,432	6,915	13,910	15,347
1976	2,131	2,141	2,150	2,163	2,131	2,046	1,955	1,869	1,879	8,866	7,045	14,193	15,911
1977	2,164	2,135	2,142	2,165	2,209	2,069	1,993	1,912	1,923	8,832	7,640	14,413	16,472
1978	2,124	2,170	2,138	2,159	2,214	2,147	2,018	1,952	1,969	8,987	7,889	14,598	16,876
1979	2,092	2,129	2,172	2,155	2,207	2,151	2,093	1,975	2,008	9,181	8,221	14,762	17,402
1980[1]	2,063	2,096	2,130	2,188	2,201	2,143	2,095	2,048	2,033	9,438	8,555	14,837	17,993
							Projected						
1981	1,972	2,068	2,098	2,146	2,236	2,138	2,088	2,051	2,107	9,633	8,999	14,864	18,632
1982	1,867	1,977	2,070	2,113	2,193	2,171	2,083	2,044	2,111	9,856	8,973	14,787	18,829
1983	1,815	1,873	1,979	2,086	2,161	2,130	2,116	2,040	2,103	10,036	9,131	14,615	19,167
1984	1,776	1,820	1,874	1,994	2,132	2,098	2,076	2,072	2,099	10,165	9,333	14,345	19,498
1985	1,798	1,781	1,822	1,889	2,039	2,071	2,044	2,032	2,131	10,250	9,575	14,028	19,825
1986	1,842	1,803	1,783	1,836	1,932	1,980	2,018	2,002	2,091	10,345	9,770	13,642	20,115
1987	1,888	1,848	1,805	1,797	1,878	1,876	1,929	1,975	2,059	10,326	9,992	13,320	20,318
1988	1,729	1,894	1,850	1,819	1,838	1,824	1,828	1,889	2,032	10,274	10,170	13,079	20,444
1989	1,636	1,735	1,895	1,864	1,860	1,785	1,777	1,790	1,943	10,202	10,295	12,914	20,497
1990	1,602	1,641	1,736	1,910	1,906	1,807	1,739	1,740	1,841	10,047	10,377	12,679	20,424

[1]Projected.

Table A-3.–School-age populations, girls, by individual ages 3-15 years: 50 States and D.C., as of July 1, 1970 to 1990
(In thousands)

Year (fall)	3 years old	4 years old	5 years old	6 years old	7 years old	8 years old	9 years old	10 years old	11 years old	12 years old	13 years old	14 years old	15 years old
1970	1,670	1,741	1,841	1,934	1,968	1,976	2,030	2,089	2,030	2,045	2,047	2,011	1,980
1971	1,628	1,696	1,735	1,858	1,938	1,944	1,999	2,118	2,020	2,044	2,052	2,083	2,005
1972	1,651	1,653	1,689	1,751	1,861	1,913	1,966	2,078	2,048	2,034	2,051	2,088	2,076
1973	1,691	1,676	1,647	1,704	1,754	1,837	1,935	2,044	2,008	2,062	2,041	2,087	2,080
1974	1,722	1,716	1,669	1,661	1,707	1,731	1,858	2,012	1,975	2,022	2,069	2,076	2,079
1975	1,578	1,748	1,709	1,684	1,664	1,685	1,751	1,933	1,945	1,990	2,030	2,106	2,070
1976	1,489	1,603	1,743	1,725	1,688	1,643	1,705	1,822	1,869	1,959	1,997	2,066	2,099
1977	1,450	1,511	1,597	1,757	1,727	1,665	1,662	1,773	1,760	1,881	1,966	2,031	2,058
1978	1,485	1,473	1,507	1,612	1,761	1,706	1,686	1,730	1,715	1,775	1,890	2,001	2,026
1979	1,463	1,508	1,468	1,521	1,615	1,738	1,726	1,754	1,672	1,728	1,782	1,923	1,995
1980[1]	1,494	1,488	1,509	1,484	1,525	1,954	1,759	1,796	1,695	1,684	1,734	1,813	1,917
							Projected						
1981	1,540	1,518	1,484	1,523	1,487	1,505	1,614	1,831	1,736	1,708	1,691	1,765	1,808
1982	1,604	1,565	1,515	1,499	1,526	1,468	1,524	1,681	1,760	1,749	1,715	1,722	1,761
1983	1,681	1,629	1,561	1,529	1,502	1,507	1,486	1,588	1,624	1,782	1,756	1,746	1,718
1984	1,754	1,707	1,625	1,576	1,532	1,483	1,526	1,548	1,534	1,637	1,789	1,787	1,742
1985	1,804	1,782	1,702	1,640	1,579	1,513	1,501	1,589	1,496	1,546	1,643	1,822	1,783
1986	1,835	1,832	1,777	1,718	1,643	1,559	1,531	1,563	1,536	1,508	1,553	1,673	1,817
1987	1,858	1,864	1,827	1,793	1,721	1,622	1,578	1,594	1,511	1,547	1,514	1,581	1,670
1988	1,874	1,886	1,858	1,843	1,796	1,699	1,642	1,643	1,541	1,522	1,554	1,542	1,578
1989	1,884	1,902	1,881	1,875	1,846	1,772	1,719	1,709	1,587	1,552	1,529	1,582	1,539
1990	1,890	1,913	1,897	1,897	1,877	1,822	1,793	1,789	1,651	1,599	1,559	1,557	1,579

[1] Projected.

Source: U.S. Department of Commerce, Bureau of the Census: *Current Population Reports*, "Population Estimates and Projections," Series P-25.

Table A-4.–College-age populations, women, by individual ages and age groups 16-34 years: 50 States and D.C., as of July 1, 1970 to 1990
(In thousands)

Year (fall)	16 years old	17 years old	18 years old	19 years old	20 years old	21 years old	22 years old	23 years old	24 years old	25-29 years old	30-34 years old	Total 18-24 years old	Total 25-34 years old
1970	1,929	1,888	1,867	1,844	1,804	1,754	1,735	1,853	1,392	6,906	5,866	12,249	12,772
1971	1,964	1,938	1,916	1,889	1,869	1,748	1,743	1,721	1,916	7,027	6,015	12,802	13,042
1972	1,988	1,972	1,965	1,938	1,913	1,810	1,737	1,729	1,780	7,586	6,230	12,872	13,816
1973	2,058	1,996	2,000	1,987	1,962	1,853	1,798	1,722	1,787	7,820	6,594	13,109	14,414
1974	2,063	2,067	2,024	2,022	2,012	1,900	1,840	1,782	1,780	8,149	6,850	13,360	14,999
1975	2,062	2,072	2,096	2,047	2,048	1,949	1,887	1,824	1,842	8,500	7,071	13,693	15,571
1976	2,052	2,071	2,101	2,119	2,073	1,984	1,936	1,871	1,886	8,941	7,196	13,970	16,137
1977	2,080	2,060	2,099	2,123	2,144	2,006	1,969	1,918	1,933	8,910	7,780	14,192	16,690
1978	2,042	2,089	2,090	2,123	2,151	2,078	1,994	1,954	1,984	9,069	8,026	14,373	17,095
1979	2,009	2,050	2,119	2,112	2,149	2,083	2,064	1,977	2,019	9,260	8,362	14,523	17,622
1980[1]	1,978	2,019	2,081	2,145	2,143	2,086	2,073	2,050	2,047	9,492	8,687	14,625	18,179
							Projected						
1981	1,901	1,988	2,048	2,105	2,172	2,076	2,073	2,056	2,119	9,691	9,139	14,649	18,830
1982	1,794	1,911	2,017	2,072	2,132	2,105	2,063	2,056	2,126	9,919	9,113	14,571	19,032
1983	1,747	1,803	1,938	2,040	2,098	2,066	2,092	2,047	2,126	10,104	9,269	14,407	19,373
1984	1,704	1,756	1,829	1,961	2,066	2,033	2,054	2,075	2,116	10,240	9,466	14,135	19,706
1985	1,728	1,713	1,782	1,851	1,986	2,002	2,021	2,037	2,145	10,331	9,703	13,824	20,034
1986	1,769	1,737	1,738	1,803	1,875	1,925	1,990	2,005	2,106	10,426	9,904	13,443	20,330
1987	1,803	1,778	1,762	1,759	1,826	1,817	1,914	1,975	2,073	10,410	10,133	13,126	20,543
1988	1,657	1,812	1,804	1,783	1,782	1,770	1,807	1,899	2,042	10,357	10,317	12,887	20,674
1989	1,566	1,666	1,838	1,825	1,806	1,728	1,761	1,794	1,964	10,273	10,452	12,716	20,725
1990	1,528	1,575	1,690	1,860	1,848	1,751	1,718	1,748	1,855	10,123	10,540	12,470	20,663

[1] Projected.

Source: U.S. Department of Commerce, Bureau of the Census: *Current Population Reports*, "Population Estimates and Projections," Series P-25.

Table A-5.–Full-time fourth-year undergraduate enrollment variable used to project bachelor's degrees by sex
(In thousands)

Year	Men	Women
1967	340	278
1968	432	354
1969	450	369
1970	451	369
1971	479	393
1972	499	409
1973	455	373
1974	537	440
1975	502	411
1976	495	397
1977	496	414
1978	486	422
1979	482	434
1980	488	451
	Projected	
1981	487	463
1982	502	490
1983	515	509
1984	510	515
1985	500	520
1986	490	515
1987	480	510
1988	470	505
1989	460	500
1990	450	490

Source: U.S. Department of Education, National Center for Education Statistics, *Fall Enrollment in Higher Education.*

Table A-6.–First-year graduate enrollment variables used to project master's degrees by sex and attendance status (In thousands)

Year	Men		Women	
	Full-time	Part-time	Full-time	Part-time
1967	117	153	49	109
1968	114	164	60	118
1969	121	173	68	131
1970	136	178	72	139
1971	141	169	72	142
1972	140	169	76	153
1973	138	172	80	167
1974	144	179	90	182
1975	150	204	96	194
1976	139	196	97	217
1977	137	192	99	214
1978	129	182	95	209
1979	127	163	99	195
1980	126	165	99	205
		Projected		
1981	134	178	108	207
1982	136	180	112	208
1983	135	183	115	212
1984	135	185	118	214
1985	134	186	119	216
1986	134	186	120	217
1987	130	186	121	218
1988	129	189	120	217
1989	126	183	120	217
1990	124	182	119	216

Source: U.S. Department of Education, National Center for Education Statistics, *Fall Enrollment in Higher Education.*

Table A-7.–Constant dollar indexes[1] 1970-71 to 1990-91 (1980-81 = 1.000)

School year	Consumer Price Index[2]	Private Nonresidential Construction Index[3]
1970-71	.460	.388
1971-72	.476	.413
1972-73	.496	.441
1973-74	.540	.502
1974-75	.600	.589
1975-76	.642	.624
1976-77	.679	.655
1977-78	.725	.713
1978-79	.793	.796
1979-80	.899	.899
1980-81	1.000	1.000
	Projected	
1981-82	1.096	1.094
1982-83	1.195	1.197
1983-84	1.289	1.305
1984-85	1.387	1.425
1985-86	1.497	1.562
1986-87	1.617	1.712
1987-88	1.748	1.868
1988-89	1.890	2.026
1989-90	2.043	2.190
1990-91	2.209	2.354

[1]For each series, the monthly indexes were averaged on a July-to-June basis to correspond to the school year.

[2]All Urban Consumer Price Index.

[3]Implicit Price Deflator for Private Nonresidential Construction.

Source: Historical and projected data were obtained from: Data Resources Inc., U.S. Microeconomic Model, Intermediate Trend Projections, October 1982.

Table A-8.–Per capita income and nonrevenue receipts of public schools, in 1980-81 dollars: 50 States and D.C., 1970-71 to 1990-91

School year	Per capita income[1]	Nonrevenue receipts[2] (millions)
1970-71	8,803	2,884
1971-72	9,091	3,047
1972-73	9,643	3,269
1973-74	9,757	3,362
1974-75	9,473	3,422
1975-76	9,621	3,487
1976-77	9,891	3,456
1977-78	10,225	3,439
1978-79	10,464	3,456
1979-80	10,263	3,467
1980-81	9,954	3,593
	Projected	
1981-82	9,978	3,743
1982-83	10,263	3,866
1983-84	10,546	4,086
1984-85	10,840	4,227
1985-86	11,064	4,316
1986-87	11,264	4,441
1987-88	11,429	4,565
1988-89	11,577	4,689
1989-90	11,695	4,814
1990-91	11,792	4,938

[1]Adjusted to July 1 through June 30 to agree with school year.

[2]Five-year moving average, lagged 4 years.

Sources: Historical data and projections of per capita income from: Data Resources Inc., U.S. Microeconomic Model, Intermediate Trend Projection, October 1982. Data on nonrevenue receipts derived from: National Education Association, *Estimates of School Statistics.*

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